

(PCT Article 36 and Rule 70)

Date of submission of the demand	Date of completion of this report
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FR2004/050632

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rule 12.3 and 23.1(b))
- ☐ publication of the international application (Rule 12.4)
- ☐ international preliminary examination (Rule 55.2 and/or 55.3)
2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1-15 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- nos. _____ as originally filed/furnished
- nos.* _____ as amended (together with any statement) under Article 19
- nos.* 1-29 _____ received by this Authority on 23.12.2005 with letter of 23.12.2005
- nos.* _____ received by this Authority on _____
- ☒ the drawings:
- sheets 1/5-5/5 _____ as originally filed/furnished
- sheets* _____ received by this Authority on _____
- sheets* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages _____
- ☐ the claims, nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to sequence listing (*specify*): _____
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages _____
- ☐ the claims, nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

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Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement		
1.	Statement		
	Novelty (N)	Claims <u>1-29</u>	YES
		Claims _____	NO
	Inventive step (IS)	Claims <u>1-29</u>	YES
		Claims _____	NO
	Industrial applicability (IA)	Claims <u>1-29</u>	YES
		Claims _____	NO
2.	Citations and explanations (Rule 70.7)		
1.	Reference is made to the following documents:		
	<p>D1: US-A-5 973 444</p> <p>D2: FR-A-2 829 873</p> <p>D3: EP-A-0 951 047</p> <p>D4: US-A-5 559 389</p> <p>D5: WO-A-99/23680</p> <p>D6: US-B1-6 465 132</p> <p>D7: US-A-2003/143398</p> <p>D8: XP 12048750, Davydov et al., Journal of Applied Physics, vol. 86, no. 7, pages 3983 - 3987</p>		
2.	Observation		
	<p>To produce nanotubes, the deposition temperature is typically 500 °C (cf. the description of the present application, page 9, lines 3 to 18; cf. D1, column 9, lines 3 to 13: 300 °C to approximately 1200 °C; cf. also D6, column 10, lines 12 to 65). At a temperature of 450 °C to 750 °C (high temperature), a non-catalytic alloy is formed between a layer of catalyst and a layer of conductive material not catalysing the formation of electrons (cf. D1, column 15, line 60 to column 16,</p>		

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	<p>line 10; column 19, lines 54 to 67; column 10, lines 9 to 25; cf. also D2, page 9, lines 15 to 35). According to claim 1 of the present application, the field-emitting device should comprise a conductive layer, referred to as the grid layer, comprising at least one layer of material catalysing the formation of electron emitters and at least one layer of conductive material not catalysing the formation of electron emitters.</p> <p>3. Novelty (PCT Article 33(2))</p> <p>3.1 D1 describes the following features (the references apply to said document; cf. column 15, line 60 to column 16, line 10; figure 4): a layer of a material not catalysing the formation 73; a layer of catalyst 77; a cathode 78; an insulating layer 71; and a second insulating layer 74 (cf. also D5, page 13, lines 20 to 23: the insulating layer is a layer of light-sensitive resin). The insulating layer 71 of figure 4 comprises only one open area.</p> <p>D1 teaches (cf. column 18, lines 34 to 67; figure 10) an insulating layer 307 comprising open areas using the preceding methods.</p> <p>D1 does not describe a porous insulating layer comprising open areas that are pores of said layer.</p> <p>An aim of D1 is to provide a high density of emitters (cf; column 3, lines 19 to 23).</p> <p>3.2 D2 describes a grid 5, 51, which does not comprise a</p>

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	<p>layer of catalyst.</p> <p>3.3 D3 does not describe a grid comprising at least one layer of catalyst (cf. paragraphs 0158 to 0160 and figure 26).</p> <p>3.4 D4 describes a grid 46 that does not comprise a layer of catalyst (cf. column 6, lines 14 to 21).</p> <p>3.5 D5 describes a grid 16 that does not comprise a layer of catalyst (cf. page 13, lines 15 to 19).</p> <p>3.6 D6 does not describe a porous insulating layer (cf. column 12, lines 57 to 62: alumina; column 12, lines 11 to 55: the grid 91 includes Cu, Cr, Ni, Nb, Mo, W or alloys thereof).</p> <p>3.7 D7 describes a grid 11 that does not comprise a layer of catalyst (cf. figures 7, 37; paragraphs 0184, 0185, 0194, 0252, 0264, 0279).</p> <p>3.8 D8 describes a grid (cf. page 3984, left-hand column, last paragraph; figure 4) that does not comprise a layer of catalyst.</p> <p>D8 also uses an angle of incidence for the deposition of the grid layer so as to prevent the pores from becoming plugged (cf. page 3983, right-hand column, third paragraph; page 3986, left-hand column, first paragraph)</p> <p>3.9 Consequently, the subject matter of claims 1 to 29 is</p>

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	<p>novel.</p> <p>4. Inventive step (PCT Article 33(3))</p> <p>4.1 D1 is considered to be the prior art closest to the subject matter of claims 1, 11 and 14 (cf. point 3.1 above).</p> <p>The subject matter of claims 1, 11 and 14 differs substantially from that of D1 in that the insulating layer is porous and comprises open areas, which are pores of said layer.</p> <p>The problem that the present invention is intended to solve can be considered to be that of dispensing with any lithographic step in the production of a field-emitting device (cf. the description of the present application, page 3, lines 6 to 10 and 20 to 22).</p> <p>The solution to this problem, as proposed in claims 1, 11 and 14 of the present application (insulating layer between the grid and the cathode, or etching mask), is considered to involve an inventive step (PCT Article 33(3)) for the following reasons:</p> <p>D1 uses at least one lithographic step (cf. photoresist 74; column 15, line 60 to column 16, line 10: initially the grid layer 73 is etched, then the layer of catalyst 77 is deposited and finally the electron emitters are formed).</p> <p>Furthermore, D1 proposes a method according to D2 (cf.</p>

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	<p>column 16, lines 25 to 44: grid 83 does not comprise a layer of catalyst), so as to provide greater flexibility.</p> <p>D8 initially uses an electrochemical deposit of a catalyst into the pores, then the formation of electron emitters and finally the formation of a grid layer made of a non-catalytic conductive material (cf. page 3983, right-hand column, last paragraph to page 3984, right-hand column, second paragraph; cf. also D3, paragraphs 158 to 160: no grid layer made of a conductive material; cf. also D7, paragraphs 0007 to 0013: problems caused by the catalyst used in D8).</p> <p>The grid layer of D8 does not comprise a layer of catalyst and all the examples of D1 use at least one lithographic step. For these reasons, the subject matter of claims 1, 11 and 14 cannot be derived in an obvious manner from a combination of D1 and D8.</p> <p>The present invention first uses a porous insulating layer, then the formation of the grid layer comprising at least one layer of material catalysing the formation of electron emitters and at least one layer of a conductor not catalysing the formation of electron emitters and, finally, the formation of electron emitters. No lithographic step is required.</p> <p>4.2 Claims 2 to 10, 12, 13 and 15 to 29 are dependent on claims 1, 11 and 14, respectively, and thus also comply, as such, with the PCT requirements of novelty and inventive step.</p>

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Box No. VII **Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

1. The units of weight/measure/temperature ("mtorr") used on page 9 are not additionally expressed in terms of the units stipulated by PCT Rule 10.1 (a) and (b).

2. Contrary to the requirement of PCT Rule 5.1(a)(ii), the relevant prior art disclosed in D1 to D4 and D6 to D8 has not been indicated in the description, nor have said documents been cited.

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. The embodiments of the invention shown in figures 4 and 7 to 9 are not covered by the claims. This inconsistency between the claims and the description casts doubt on the subject matter for which protection is sought. The claims are therefore not clear (PCT Article 6).
2. Claim 25 is not clear. The electron emitters are obtained by electrochemical deposition of an emissive metal and are made of carbon (cf. claim 24; cf. claim 17 of the prior national application; according to one of claims 11 to 14).